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Monitoring of Older Adult's Joint Pain Management by Families Based on Information Technology (IT) Platform

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Abstract

Older adults experience an aging process that impacts a decrease in physiological function. Joint pain is one of the negative consequences of decreased physiological function. Older adults need a continuum of care to deal with the perceived vulnerability due to the effects of pain. The family has a role in self-management at home, but sometimes families experience difficulties in the mentoring process because of their high productivity outside the home. The research aims to explain monitoring on the pain scale, knowledge, skills, self-efficacy of older adults, and the level of family independence based on Information Technology (IT) platform. The method used is a case report on an older adult and the family for two months of monitoring. The intervention consisted of 4 meetings using psychoeducational techniques, cognitive restructuring, demonstration, and problem-solving. The result showed a decrease in the pain scale and an increase in the knowledge, skills, and self-efficacy of older adults. In addition, the result showed increased family independence after intervention. The family has an essential role in accompanying older adults during the joint pain management process. This result is expected to be a recommendation for health workers to maximize the part of the family in treating pain management in older adults.

INTRODUCTION

The elderly group biologically experiences an aging process characterized by decreased physiological function, which results in susceptibility to illness and death. The consequence theory also explains that the decline in physiological function that occurs in older adults is due to changes in the aging process (Miller, 2012). Musculoskeletal function is a decrease in physiological function that occurs in older adults. Muscle and joint disorders, such as arthritis, characterize this decreased function's negative consequences. In general, the symptoms caused by arthritis by the pain response of the sufferer. Pain due to arthritis problems causes older adults to limit movement so that the range of motion of the joints can dwindle. That can affect the productivity and quality of life of older adults.

The Indonesian Medical Gerontology Association (PERGEMI) survey results in 2022 show that 24.6% of older adults in Indonesia have a history of chronic disease (Perhimpunan Gerontologi Medik Indonesia, 2022). The three significant chronic diseases in the elderly group are hypertension (37.8%), diabetes (22.9%), and rheumatism (11.9%). That is in line with a survey by the Ministry of Health, which showed the prevalence of joint disease in Indonesia was 15.55% for ages 55-64 years, ages 74 years (18.63%), and generations >75 years (18.95%) (Kementerian Kesehatan RI, 2018). Joint disease is experiencing a downward trend compared to previous years. That is because the consequences of joint disease can interfere with older adult's physical, mental, and social conditions. Changes in function or disability can impact body function and structure disorders, activity barriers, and social participation disorders (Allender et al., 2010).

The problem of joint pain can interfere with the quality of life of older adults if continuous treatment is not sustainable. Arthritis can cause complaints of pain, stiffness, and mobility

restrictions, thus affecting psychological and social conditions (Miller, 2012; Allender et al., 2015). This situation causes activity limitations and creates a dependency of older adults on the productive age group. This is in line with the 2018 Basic Health Research report showing the level of dependence of older adult due to joint disease in the categories of mild dependency (28.44%), moderate dependence (1.52%), severe dependence (1.13%), and total dependence (1.46%) (Kementerian Kesehatan RI, 2018). This condition causes a high economic burden on the family because in general, the older adults who are dependent need funding for therapy and rehabilitation. Not only has an impact on the financial burden, but the high dependence on older adults can also affect productivity and quality of life (García & Ramírez Navarrro, 2018).

Self-management is an effort to improve the patient's ability to manage signs and symptoms, treatment, physical and psychosocial consequences, and lifestyle changes due to chronic illness (Warner et al., 2019). The self-management process can be through health education, counseling, and nursing care. The success of this self-management process is not only focused on the individual but also carried out with the aim of the family. One of the forms of continuing care for controlling arthritis problems at home is to monitor the regularity of the patient's activities and provide counseling (Nies & McEwen, 2015).

Various studies show that self-management interventions have good results but also include some problems and difficulties, such as the limitations of health workers in introducing self-management and evaluating the interventions provided (Franklin et al., 2021). One way to overcome this limitation is to utilize new technology to manage self-care to improve joint pain management (Azevedo et al., 2015; Choi et al., 2019). Android-based applications refer to Family Care Nursing and Community as Partner concepts. These two nursing concepts explain that families and communities should utilize health facilities to improve their health (Allender & Spradley, 2005; Friedman et al., 2003). The design of an Android-based application is to make it easier for families and communities to consult directly with health workers. This effort is carried out as a supporting medium for self-management, thereby facilitating the implementation of behavioral changes in older adults in treating joint pain, especially in the utilization of health facilities.

The Information Technology-Based Application Lansia SMART was developed to assist families and older adults in monitoring and implementing self-management with joint pain. In the self-management process, smartphone-based applications can be used as information, advice, and support in monitoring or recording the cycle of chronic disease self-management (Azevedo et al., 2015). Based on previous research, innovation is needed to overcome the limitations of health workers in monitoring the self-management of older adults with joint pain. One of the efforts is using the "SMART Elderly Information Technology-Based Application" to facilitate access for families and older adults to monitor changes in behavior. This application consists of screening caloric needs, physical activity, and pain levels to monitor self-management developments by older adults. In this application, there is also an educational menu that is easily accessible by families, thereby helping families to accompany the behavior change process. In addition, older adults and families can connect directly to health workers through this application. The existence of this smartphone-based application is to make it easier for older adults to monitor the development of their self-management process to create healthy living habits. Based on this, this research aimed to explain Information Technology (IT) as a platform to monitor Older Adult's Joint Pain Management by families based.

RESEARCH METHODS

a. Design Study

This intervention was carried out using the case report method in one family of elderly with joint pain problems. The research aims to explain monitoring on the pain scale, knowledge, skills, self-efficacy of older adults, and the level of family independence based on the Information Technology (IT) platform. The intervention provided is to maximize self-management implementation by utilizing an application based on information technology called Lansia SMART. The inclusion criteria for this study are (1) Older adults> 60 years, (2) Older adults who feel significant joint pain, (3) Living with family, and (4) a Family who has an Android smartphone. Implementing these interventions is supported by developing the Lansia SMART application as

monitoring and educational. This research has passed the ethical test with No. 59A/UPPM/Etik/STIKES-AH/II/2020.

b. Instruments

The intervention results are described in achieving family independence and improving pain levels, knowledge, skills, and self-efficacy of older adults. The instrument used is the WOMAC index, with a validity value of 0.48-0.53 (p>0.05) and a reliability of 0.9 (p>0.85) (Soininen et al., 2008). In addition, the instrument for measuring the value of elderly knowledge about arthritis management uses a modified Patient Knowledge Osteoarthritis questionnaire (Sahrudi, 2018). The self-efficacy value instrument was modified based on the Rheumatoid Arthritis Self-Efficacy Questionnaire (RASE) instrument. Evaluating the level of family independence uses instruments developed by Hayati (2019) regarding the level of family independence in caring for older adults.

c. Analysis of Respondent Situation

Elderly, 69 years old, lives with her two children. The anthropometric examination showed that older adults weighed 68.4 kg, had a height of 153.5 cm, and had a BMI of 29.2 kg/m^2 (overweight). The family said older adults often complained of joint pain in their knees and fingers for the past year. According to older adults, pain occurs when doing sewing activities and going up or down the stairs too much at home. The pain is like being pinched and often occurs in the knee and finger areas. According to older adults, the pain scale that is felt is 4 out of 10. This pain can occur throughout the day after carrying out activities that cause pain.

The initial assessment showed that the WOMAC score regarding pain and physical activity index in older adults was 28% (moderate risk). Older adults also have poor skills in joint pain management. Based on filling out the questionnaire for older adults, the total value of skills in treating joint pain was obtained with a score of 10 (mean <10.4). In addition, older adults have low knowledge of caring for older adults with joint pain, namely a score of 3 (mean <4.6). Older adults need better knowledge and skills in treating joint pain.

d. Intervention

1. Concept of Family and Self-Management

Self-management of older adults with arthritis is carried out using the principles of family nursing care. This nursing concept views the family into five parts, namely: (1) The family as the context, (2) The family is a collection of its members, (3) The family subsystem is the client, (4) The family is the client, (5) The family as a component public. The family has a health care function which consists of the main tasks of the family in recognizing problems, making decisions, carrying out care, modifying the home environment, and utilizing health facilities (Friedman et al., 2003). Therefore, interventions that focus on improving self-management are needed to increase knowledge and skills regarding the treatment of joint pain by families and older adults. Self-management care can be carried out at home by monitoring the regularity of patient treatment and providing counseling (Nies & McEwen, 2015). Based on this, self-management is carried out by paying attention to developing family care at each meeting in dealing with joint pain problems.

Many interventions can be applied through health education and counseling to improve self-management. Health education is one of the methods given in self-management to prevent joint pain, such as doing physical activity, consuming a healthy diet, and reducing alcohol consumption and not smoking (Omura et al., 2018;WHO, 2013). Several studies have shown that counseling can also treat joint pain by providing information regarding an isometric exercise to reduce pain (Kangeswari et al., 2021). The frequency of monitoring from health workers to patients is often a limitation in the self-management process. Therefore, technology and information-based applications have been developed to facilitate nurses in monitoring patient self-management.

2. Lansia SMART is an Application based on Information and Technology to Monitor the Joint Pain Management of Older Adults

One of the innovations is to utilize new technology in chronic disease self-care to overcome limitations in the self-management monitoring process (Azevedo et al., 2015; Choi et al., 2019). This intervention improves health by providing information, advice, and support in monitoring or recording forms of chronic disease self-management. The results of a review conducted by Portelli& Eldred (2016) describe that smartphone applications facilitate clients in setting self-management goals. Therefore, the SMART Elderly application has several benefits, including (1) increasing the knowledge or skills of families and older adults about the treatment of arthritis; (2) increasing the level of awareness and older adults to prevent the ongoing impact of arthritis; (3) providing convenience for families in monitoring the development of joint pain, carrying out physical activities, and monitoring body weight and calorie needs; and (4) families and older adults make it easy to consult with health workers.

Lansia SMART application is compiled using the Android Beta version 1.0. This application is designed for subjects who can access and use it, especially older adults. Therefore, this application can be accessed easily by users with any smartphone. Figure 1 describes a flow chart for using Lansia SMART Application innovation as a technology that supports self-management improvement.

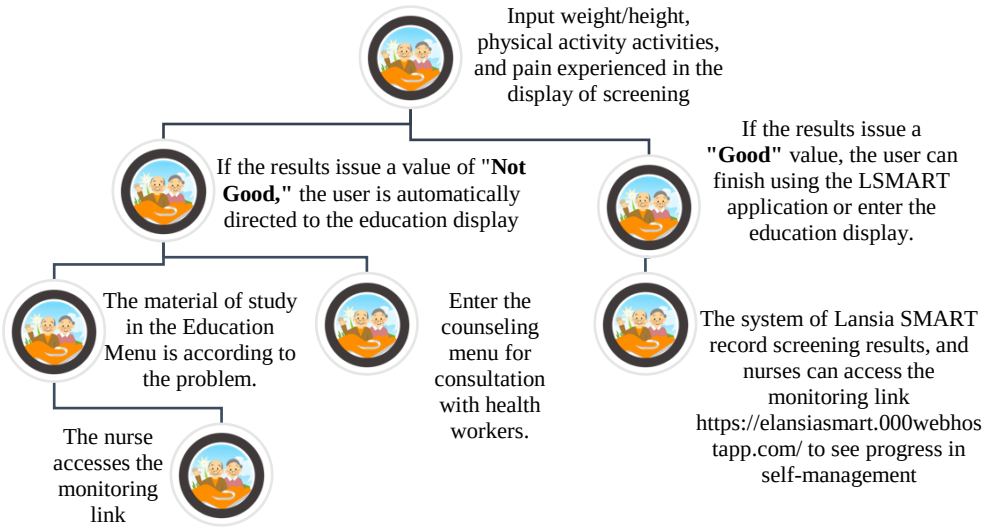
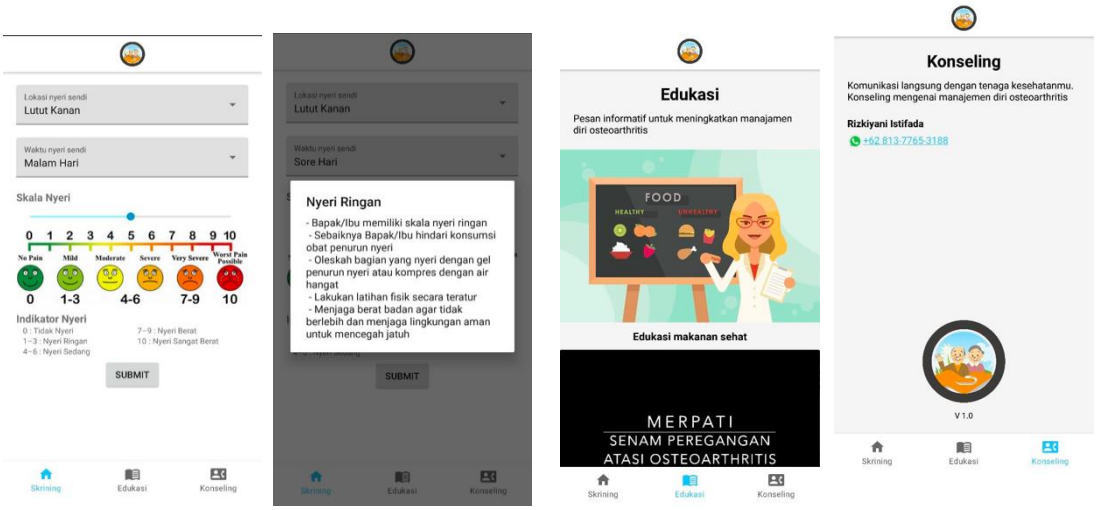


Figure 1. Flowchart Lansia SMART

Evaluation of the use of the Lansia SMART application is directly monitored by the compilers and health workers who have been given training. The monitor of the self-management process utilizes a database link that can be accessed using a password by health workers. The form of monitoring development is arranged in the form of input data in accordance with the records filled in by the older adults and their families. The data recorded by the system is in the form of the date of filling out the screening, the results of the calorie requirement screening, the value of physical activity, and pain monitoring. If the results show that the category is not good, then nurses can monitor directly by providing counseling to the elderly and families via WhatsApp messenger connected to the application. This can make it easier for nurses to monitor the progress of self-management of the elderly without home visits which is a limitation for nurses. Older adult and family can also access evaluation by reading recommendations which can be accessed automatically after screening data is inputted. This recommendation is also connected to the education and counseling display if the screening results show a bad category (Figure 2).



(a) (b) (c)

Figure 2. (a) Display of Screening, (b) Display of Education, and (c) Display of Counseling

This intervention carried out four home visits and online monitoring for two months. The interventions carried out included health education, counseling, monitoring pain management, and recording skills through the Lansia SMART application. Table 1 describes the stages of monitoring joint pain management in older adults and their families.

Table 1. Information Technology-Based Joint Pain Management Monitoring Interventions in Older Adults and Families

Meeting	Intervention	Media
1st Meeting	Using psychoeducational techniques: - Explain the causal factors - Describe the early signs and symptoms of the disease - Explain the benefits of self-management - Describe strategies for managing joint pain	Using media picture cards to identify the understanding of older adults and their families about the symptoms that they feel and the various treatment options for joint pain management Informing the benefits of the Lansia SMART application by accessing the educational menu for explanations of strategies for managing joint pain
2nd Meeting	Using cognitive restructuring methods to determine family and elderly commitment in joint pain management In this activity, older adults and their families are assisted with behavioral picture cards to show their skills when dealing with joint pain. After identifying their skills, older adults and their families practice determining their commitment and a behavior change plan written in their pain monitoring journal.	Using the identification sheet for the causes of joint pain and the action plan sheet for managing pain Using the Lansia SMART application on the screening menu to identify the elderly pain scale, physical activity, and BMI
3rd Meeting	Using the demonstration method by practicing Progressive Muscle Relaxation (ROP)	Using the Lansia SMART application in the education menu to watch videos of Progressive Muscle Relaxation (ROP) Re-practicing ROP skills accompanied by family

4th Meeting	Using the Problem-Solving technique approach Provide a stimulus to families and older adults by providing various case management questions to solve problems in treating joint pain.	Using problem-solving behavior cards Utilizing the Lansia SMART application in monitoring self-management by accessing physical activity level screening and pain monitoring levels

RESULT

Lansia SMART technology-based application assists families in monitoring joint pain management. Families access this application as a medium that helps change the skills of older adults. This designed application consists of health screening to monitor the development of changes in elderly behavior, such as monitoring pain scales. The following are the benefits of information technology-based applications in helping families monitor the management of elderly joint pain.

a. Pain Level Scoring

The results showed decreased joint pain scoring during four meetings (Chart 1). At the implementation of the first and second visits, the range of elderly pain was in the moderate category, with a score of 4. At the first and second visits, the implementation still introduced complementary therapies that were easy to use and accessible in the education menu of the SMART Elderly application. This condition causes pain scoring to still be in the moderate category range. Joint pain decreased on the mild category scale at the third and fourth meetings.

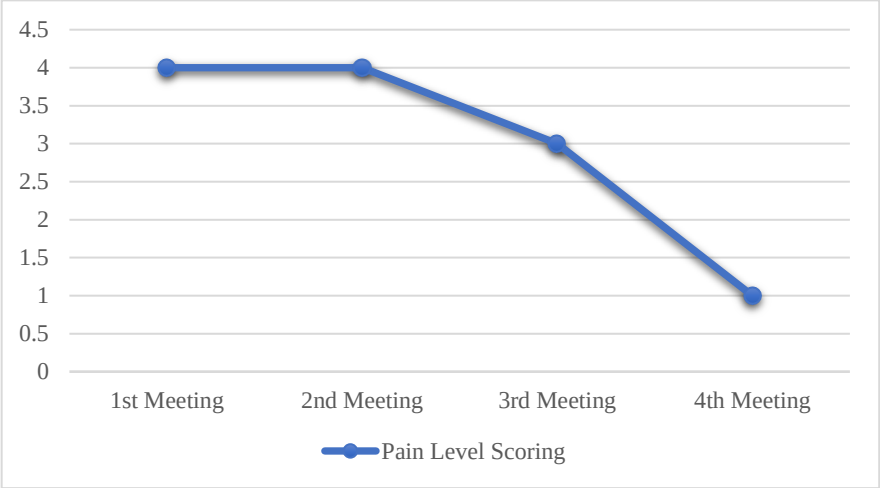


Chart 1. Pain Level Scoring of Older Adult

b. Knowledge, Skills, and Self-efficacy of Older Adult

The evaluation results showed an increase in the value of the knowledge, skills, and self-efficacy of older adults after the intervention. In the knowledge category, older adults' scores increased from 3 (three) to 6 (six), with a maximum score of 8 (eight). Likewise, in the skills category, there was an increase in scoring from 10 (ten) to 16 (sixteen), with a maximum score of 21 (twenty-one). Then in the self-efficacy category, older adults' scores increased from 21 (twenty-one) to 53 (fifty-three), with a maximum score of 60 (sixty). Based on this, a significant increase occurred in the category of self-efficacy.

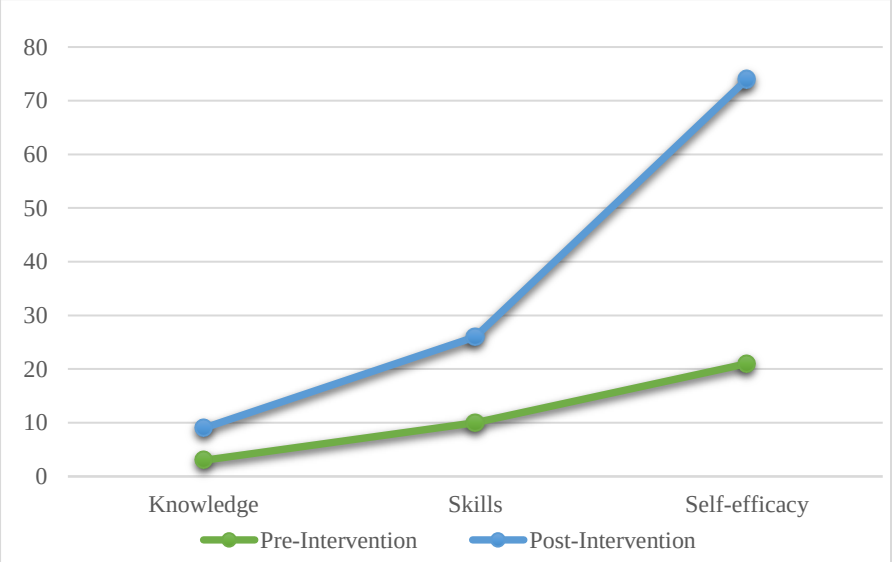


Chart 2. Knowledge, Skills, and Self-efficacy Scoring

c. Family Independence Level

The level of family independence has changed after being given joint pain management interventions using technology and information-based applications (Table 2). Before the intervention was given, the level of family independence was in category I (one). The definition of this category is that families can only receive nurses and health services. After the intervention was given, there was an increase in family independence to the level of category III (three). In this category, families already have good independence, such as using health facilities, expressing their health problems, and taking preventive and nursing actions according to recommendations. Families are actively committed to monitoring elderly self-management through applications. This shows that there is an increase in family independence in dealing with the problems of family members who are sick.

Table 2. Family Independence Level

	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria7
Pre-Intervention	√	√					
Post-Intervention	√	√	√	√	√	√	

* Information:
Criterion 1: The family accepts the nurse
Criterion 2: The family receives health services according to the family nursing plan
Criterion 3: The family knows and can express their health problems correctly
Criterion 4: Families utilize appropriate healthcare facility's recommendation
Criterion 5: The family performs simple nursing actions according to recommendations
Criterion 6: The family takes active preventive measures
Criterion 7: The family takes active promotive actions

DISCUSSION

Self-management interventions that utilize Android applications as media can increase behavior in the monitoring process. Based on research by Azevedo et al. (2015) described that Android applications are used to improve health by providing information, advice, and support in monitoring or recording forms of self-management of chronic diseases, one of which is joint pain. Implementation of arthritis self-management by utilizing internet technology is effective in improving health status (Mollard& Michaud, 2021).

There was a decrease in pain scoring because older adults and their families do training in progressive muscle relaxation techniques to overcome or prevent pain. Progressive muscle relaxation

techniques are taught to families to improve elderly coping in reducing joint pain. Based on the research of Kazak &Ozkaraman (2020) that progressive muscle relaxation can reduce chronic pain. If the family is informed about the skills of progressive muscle relaxation techniques, the family expects to have an increase in coping strategies in dealing with pain. The effectiveness of reducing the pain scale also occurs because families and older adults are trained to manage activities in a daily journal. However, the elderly struggle to commit to writing in a daily journal, and the family helps monitor the pain scale through the Lansia SMART application screening menu. Based on research by Kuerbis et al. (2017) that the use of mobile health can overcome obstacles in implementing interventions for older adults. Commitment to writing activities in a journal and recording pain scales in the Lansia SMART application impacts rapid changes in health behavior. Someone who follows the stages of cognitive behavior sessions by using information technology applications can effectively reduce perceived pain (Helminen et al., 2015). Therefore, Android-based applications are one of the supporting factors in the success of nursing care interventions to improve the self-management of older adults and their families.

There was increasing the value of knowledge, skills, and self-efficacy due to the commitment of older adults to implementing joint pain management. Older adults, always accompanied by their families during interventions, have high motivation and commitment to change their behavior. Older adults not accompanied by their children tend to have an increased knowledge and skills that is not significant to their ability to manage their pain. The results of previous research also explained that family support can change the behavior of older adults to become more health-conscious (Rekawati, 2014). Based on this, the importance of family support to successfully implement joint pain management can be interpreted.

Families need more time to carry out interventions due to comorbidities for older adults besides joint pain, such as hypertension. Even so, something unique happened during the implementation of the intervention, in which older adults had increased skills in self-management of joint pain. These results align with previous studies which explained that social functioning and family support were higher in older adults with comorbid (Rekawati et al., 2019).Families with elderly with comorbid health problems tend to have high protection in caring for their parents. This condition affects the improvement of skills, although commitment still has obstacles. In line with previous studies, their commitment and resilience are often related to self-care for patients with comorbidities (Jin et al., 2023).Therefore, there is an increase in skills due to family support in monitoring the self-management of older adults. The existence of information technology-based applications makes it easier for families to monitor changes in healthy behavior in older adults.

Self-efficacy is influenced by a person's or the environment's experience in carrying out the skill process and wants to believe in reducing pain (Hayward & Stynes, 2021).The intervention results in the family showed an increase in older adults' self-efficacy after the Lansia SMART intervention. Based on subjective data from anamnesis, older adults feel the benefits of implementing self-management skills, such as pain intensity rarely occurring and daily activities are not disturbed. A significant increase occurred in the self-efficacy score of older adults. Improving self-efficacy is supported by a good family socioeconomic level in monitoring the management of elderly joint pain. This condition is one of the factors that cause the value of self-efficacy to increase. The study's results also explain that increasing self-efficacy is influenced by social support, which helps optimize health care (Miller et al., 2019). Information technology-based applications can be used to increase older adults' belief in healthy behavior.

The intervention results show that monitoring based on the Lansia SMART application can increase family independence. Lansia SMART can affect the ability to implement self-management in older adults. The results of previous research also explained that the level of family independence affected the family's ability to care for older adults (Nugroho, Asti, & Solechan, 2016). However, this intervention's results have yet to increase family independence ideally. This condition happens because of the socio-economic conditions of the family, which affect the application of the self-management process. The level of family independence is influenced by family care (Kertapati, 2019). If the family has limitations in providing care to family members, then the implementation of the intervention will be affected and not optimal. Based on the family concept, Friedman also

describes that family care tasks are influenced by social, economic, cultural, and spiritual factors (Kaakinen et al., 2010).

Lansia SMART is designed to improve the ability of older adults to monitor self-management. The fact is that the characteristics of older adults in Indonesia have yet to be exposed to much access to the use of smartphones. They consider smartphone access, not a necessity that must be understood and owned. Older adults generally only accept the benefits of technology if the application is precise (Peek et al., 2014). This condition is challenging in carrying out self-management monitoring innovations using information technology-based applications. Based on the evaluation results, their families fully assist older adults in accessing the Lansia SMART application for self-monitoring. This condition is sufficient to affect the commitment to fill in self-monitoring carried out by older adults. Based on previous research, older adults who live not with their partners and children tend to use smartphone applications as a medium that facilitates their daily activities (Zhao et al., 2020). Therefore, this application can also be used by older adults independently. This application is optimal when older adults and their families are committed to filling out monitoring, such as at least once in two days.

CONCLUSION

Families can use applications based on information technology for the Lansia SMART to monitor joint pain problems. The interventions showed a decrease in the pain scale and an increase in the knowledge, skills, and efficacy of older adults in self-management. This application also increases the independence of the family to care for older adults with health problems. Family support can maintain and improve older adults' physical and psychological health. This condition also has an impact on the quality of life of older adults, as well as the socio-economic conditions of the family. However, this intervention has limitations regarding the target number of elderly and families given implementation. In the subsequent intervention, it expects that the target will reach older adults and family groups so that the benefits of the innovation can be widely felt. The benefits of this application are also felt by health workers who can provide care remotely. Health workers can directly monitor screening results and provide consultation through the menu in the Lansia SMART application. The results of this innovation provide recommendations to health workers at primary health care regarding the effectiveness of monitoring the self-management of older adults and their families.

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